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University of Cambridge
School of Agriculture Memoirs

Memoir No. 8

A brief summary of the papers published by
the Staffs of the School of Agriculture and
its Associated Research Institutes during
the period Oct. 1st, 1935—Sept. 30th, 1936.



1936

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FOREWORD

This Memoir, which is published under the general editorship of the Librarian of the School, represents an attempt to present as succinctly as possible the contributions made by members of the Staffs of the School of Agriculture and its Associated Institutes to the development and progress of Agricultural Science, to indicate to research workers interested the Journals in which the full papers are presented and to act as a complete record of papers published. Each summary is compiled by the author of the paper and is presented, so far as the subject matter will allow, in a non-technical form in order to be of value to the general body of farmers interested in the more recent developments of agricultural scientific research in general and of the activities of this Department in particular.

Requests for further information or criticism arising out of the summaries should be referred to the individual author concerned, criticisms and suggestions for the improvement of the Memoir itself should be addressed to the Librarian of the School.

E. T. H.



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Members of Staffs, summaries of whose papers are included in these Memoirs.

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University of Cambridge

School of Agriculture Memoirs

THE SCHOOL OF AGRICULTURE INCLUDING ESTATE MANAGEMENT, THE ADVISORY SERVICES AND ASSOCIATED RESEARCH INSTITUTES

Agricultural Education in Cambridge dates from 1892 when the Cambridge and Counties Agricultural Education Committee, an informal body consisting of University Professors and County Council representatives, first organised an Agricultural Course. In 1899 the University created a Department of Agriculture to take over the work of this Committee. The School of Agriculture was built by public subscription in 1909 and expanded by a grant from the Development Commission in 1912. The rapid expansion of the Animal Nutrition Institute and the Plant Breeding Institute under the direction of Professor T. B. Wood and Professor R. H. Biffen led to increased demands on accommodation, and an extension to the building was made in 1925-26 by the aid of a further grant from the Development Commission. The Estate Management Branch has been added since the war for the purpose of providing technical and professional assistance in the management of University and College property and with a view to affording opportunities for practical demonstrations in connection with the teaching of Estate Management subjects.

The Rockefeller Benefaction, made to the University in 1929, provided money for additional accommodation for the Department of Agriculture and for an expansion of its activities, and a new building was completed and occupied in March, 1933.

The Department of Agriculture is primarily a teaching department of the University, but research in the problems of agriculture and cognate sciences is carried out by members of the teaching staff and by members of the staffs of the Research Institutes attached to the Department. Additional facilities for both teaching and research are provided by the University Farm which occupies an area of some 700 acres within reasonable distance of the scientific laboratories.

*Reprints available for free distribution. Please quote marginal number instead of full title. Enquiries for papers not starred should be sent to the author.

AGRICULTURE.

CULPIN, C.

"The Future of Rotary Cultivation."

Impl. Mach. Rev. 1936, **62**, 471.

In a short paper reviewing the potentialities of rotary cultivation, the writer discusses the objects and methods of tillages and compares the efficiency of cultivation by the rotary and traditional methods.

427* ENGLEDDOW, F. L.

"Scientific Progress in Agriculture."

J. Chart. Surv. Instn. 1936, **16**, 13-39.

A review is made of advances in British agricultural practice recently brought about by the application of science as distinct from advances in agricultural science itself. The following components of agriculture are dealt with in turn: land, climate, soil (including cultivations and manures), plants, animals, disease, power, transport and storage.

439* GARNER, F. H. and SANDERS, H. G.

"Investigations in Crop Husbandry. IV. The Preparation of the Seed Bed for Wheat After Potatoes."

J. Agric. Sci. 1936, **26**, 415-423.

Experiments were carried out in four successive years to compare the plough and the cultivator as implements for preparing a seed bed for wheat after potatoes; in the last two years direct drilling was introduced as a third treatment. Very diverse conditions were experienced, and an attempt has been made to formulate practical recommendations.

386* SANDERS, H. G.

"Cultivations."

J. Fmrs' Cl. 1935, (Pt. 5), 81-100.

It is argued that the subject of tillage merits more research than is devoted to it at present. A brief description is given of experiments on seed bed preparation and on the after-cultivation of the wheat crop.

OTHER PAPERS.

BIFFEN, R. H.

"Annual Report for 1935 of the Botanist."

J. R. Agric. Soc. 1935, **96**, 492-499.

BIFFEN, R. H.

"Huskless Oats."

J. Minist. Agric. 1936, **43**, 8-10.

Essex Fmrs' J. 1936, **15**, 72-73.

GARNER, F. H. and SANDERS, H. G.

"When Wheat Follows Potatoes."

Fmr and Stk-Breed. 1936, **50**, 2239.

MANSFIELD, W. S.

"The Place of the Horse in Mixed Farming."

Fm and Mach. 1936, 3, 108-113.

MANSFIELD, W. S.

"The University Farm, 1935."

Camb. Univ. Agric. Soc. Mag. 1936, 5, (No. 1), 16-21.

SANDERS, H. G.

"Farm Rotations in Mechanized Farming."

Fm and Mach. 1936, 3, 44-52.

AGRICULTURAL CHEMISTRY.

379* ENGLEADOW, F. L. and WOODMAN, R. M.

"The Use of a Wetter in Weed Spraying."

J. Minist. Agric. 1935, 42, 663-666.

The use of soap as a wetter with sulphate of ammonia in destroying weeds in lawns by spraying is described. Very much higher efficiency is attained with the weeds on which the experiments were conducted than when a solution of sulphate of ammonia alone is employed. It is considered that the principle of incorporating a wetter may have a number of applications in weed spraying.

AGRICULTURAL ECONOMICS.

"Changes in the Economic Organisation of Agriculture—a Comparative Study of Conditions in the Eastern Counties of England in 1933 and 1935."

Fm Econ. Br. Rep. No. 23. Pp. iv + 36. Price 1/6 net. Postage 2d.

The data here given refer to an identical sample of 220 farms in the two years 1933 and 1935. The sample has been selected from four important "type of farming" districts within the Eastern Counties. While the results do not purport to describe conditions throughout the Province as a whole, they are probably reasonably representative of the financial and economic *changes* which have taken place within the types of farming covered.

Although the average profit obtained in 1935 by these 220 farmers is similar to that of 1933, considerable variations occur in the results recorded for the four individual type of farming districts. In two of these districts (central Norfolk and south Essex) there has been an improvement; on the north Essex boulder clays the position is unchanged; the south Cambridgeshire district alone shows a deterioration. As the south Cambridge chalk land area is representative geographically of a much smaller proportion of the Eastern Counties than are the other three districts collectively, it may perhaps be inferred that, considering the Province as a whole, profits have improved during the last two years.

There have been great changes in the amount and composition of total income and expenditure. Over all the 220 farms the gross income has increased by 14 per cent., and the gross charges by $17\frac{1}{2}$ per cent. The rise in income is due primarily to larger receipts for pigs, cattle, milk, sheep, hay, potatoes, and oats. The rise in costs

is mainly due to larger expenditure on feeding stuffs, store livestock, labour, fertilisers, and seeds. These increases in income and expenditure are due more to changes in the quantity of produce sold and bought than to changes in unit prices and costs. In other words, production has been intensified.

There have been increases in the quantitative output of dairy produce, pigs, and horned stock, but the output of poultry and sheep has decreased. Collectively the quantitative output of all livestock and livestock products shows an increase of 10 per cent. This composite index is computed by valuing the 1935 output on the basis of the 1933 prices and expressing the result as a percentage of the 1933 values. As compared with this the quantities of crops sold appear to have risen by about 6 per cent. In connection with these estimates it should be noted that they are expressed on the basis of *per farm*. As the area of the farms surveyed was 2 per cent. larger in 1935 than in 1933, the index of output *per acre* will be 8 per cent. for livestock and 4 per cent. for crops.

There are many dangers in attempting to combine crops and livestock in a single output figure. For example, the amount of crops retained on farms for consumption by livestock has not remained constant in both years, while the quantity of feeding stuffs purchased has altered considerably. A direct combination of livestock output and crop sales gives a figure of 6 per cent. as a measure of the increased productivity per acre of these farms between 1933 and 1935. But if purchased feeding stuffs are deducted, the figure is reduced from 6 per cent. to 3 per cent.

This larger quantitative output has been obtained without a commensurate increase in employment, and the physical output per worker has risen proportionately to that of output per acre.

There is some indication that the livestock output per unit of food consumed has increased as a result of greater efficiency in management. The estimates given suggest that the quantities of foods consumed have risen 5 per cent., compared with a 10 per cent. increase in the livestock output. Both milk yield per cow and egg yield per hen appear to have improved.

The quantities of feeding stuffs purchased show an increase of as much as 18 per cent. This coincides with a considerable decline in the proportion of the farmed area utilised for growing fodder, and with a marked rise in the livestock output.

Of the total farmed land the proportion under the plough has increased from 65 per cent. in 1933 to 66 per cent. in 1935. Further, there has been a substantial fall in the acreage of bare fallow. The proportion of the total farmed area from which the crop produce was marketed direct increased from 37 per cent. in 1933 to 44 per cent. in 1935.

The quantity of inorganic fertilisers purchased has increased by as much as 20 per cent.

The increase in livestock density has involved larger purchases of store and breeding stock.

“ Farm Profits and Some Profitable Farms.”

Fm Econ. Br. Fmrs' Bull. No. 4. Price 6d. Post Free.

Written for farmers, this bulletin discusses some of the characteristics of profitable farms, and describes the organisation of eight farms which have yielded substantial profits during recent years. As a generalisation it seems safe to say that the farmers getting the better profits have a more intensive organisation than their less

successful neighbours : they generally have more livestock, buy more fertilisers and feeding stuffs, and obtain higher yields from crops and livestock. But there is another outstanding characteristic of profitable farms. It is true that they generally spend more on purchased feeding stuffs and fertilisers, and frequently more on labour, but they also produce more per £ spent.

“ Management in Milk Production.”

Fm Econ. Br. Fmrs' Bull. No. 5. Price 6d. Post Free.

This bulletin summarises, primarily for farmers, some of the information already obtained in connection with a Food Recording Scheme for Dairy Cows, established in the Spring of 1934. The main object of the scheme is to assist its members to secure economies in the management of their herds, and in this, as the bulletin shows, it is proving successful. The most striking general impression obtained from the summarised results is of the wide ranges which occur in production, costs, and profits. It seems that many farms having high feeding costs could economise considerably by more careful control of the food consumption of individual cows, and also of the herd as a whole.

413* CARSLAW, R. MCG.

“ In Defence of Mixed Husbandry.”

J. R. Agric. Soc. 1935, 96, 5-22.

In the eastern counties of England the majority of farmers produce at least 12 different commodities, and sell at least six. The comparative advantages of such diversification are discussed under the headings (1) creation and use of by-products, (2) seasonal distribution of labour, and (3) seasonal distribution of income and expenditure. Quantitative data are given, and the conclusion arrived at is that the economic advantages of mixed husbandry outweigh the disadvantages due to absence of specialisation.

446* CARSLAW, R. MCG.

“ The Eastern Counties.”

Contribution to the symposium “*Regional Types of British Farming.*” Pp. 113-132. Allen and Unwin, London, 1936. Price 12s. 6d. net.

380* CARSLAW, R. MCG. and GRAVES, P. E.

“ The Labour Bill and Output on Arable Farms.”

J. R. Stat. Soc. 1935, 98, 601-637.

Details of the labour bill and output on approximately 1000 farms for three consecutive years provide the basis for this investigation. The main conclusions may be summarised as follows.

In discussing the financial aspects of the farmer's labour bill it is necessary to distinguish between (a) wage rates, (b) workers' earnings, and (c) cost to the employer. The cost to the employer is 11 per cent. more than wage rates and 3 per cent. more than workers' earnings. When the cost per worker for each of the three wage-earning categories is adequately weighted, the average cost for all regular farm employees amounts to 12 per cent. more than the minimum wage rate for “ordinary” workers.

Casual labour is an important item on arable farms, representing an addition of more than 10 per cent. to the cost of regular workers.

The labour bill represents nearly 36 per cent. of the gross farm costs, but if the value of the occupier's own work is included, this proportion is raised to an almost uniform figure of 41 per cent. for each size group.

During the period 1931-33 the wage paying capacity of arable farms has varied directly with the size of the farm.

The amount of capital invested in farm live and dead stock is equivalent to £300 per manual worker. If the value of land and buildings is included the total capital represents nearly £900 per manual worker.

Density of employment is influenced more by the size of the farm than by the proportion of arable land to grass.

The value of the gross output per unit of labour is a factor closely associated with profitability. The types of commodities produced, as well as the methods of production employed, will influence the output per unit of labour. The net output represents approximately two-thirds of the gross output.

Both the gross and net output per person increase directly with size of farm, but the increase occurs at a decreasing rate. The point at which the increase may cease to occur depends on the system of farming.

For the period 1931-33 the social output was distributed in the proportions of 58 per cent. to labour, 22 per cent. to the land-owner, and 20 per cent. to the farm capital and occupier.

414* CARSON, S. H.

“Half a Century of Changes on an East Anglian Farm.”

J. R. Agric. Soc. 1935, 96, 45-78.

This investigation of changes in the organisation of a certain Suffolk farm shows great alterations both in the type and methods of production since 1877. The changes are traced and measured by means of a complete series of financial accounts kept by the occupier throughout the entire period. While the main interest in the study lies in the details it provides of how adjustments have been made to meet changing price and cost conditions, the following table is here quoted to show the fluctuations which have taken place in the amount and distribution of the net output of the farm.

Amount and Distribution of the Net Output of a Suffolk Farm, 1877-1933.

Period	Net Output per 100 acres	Percent. Distribution of Net Output			Net Output per “worker unit”
		Labour	Landlord	Farmer	
	£	%	%	%	£
1877-1889	322	63	46	(-) 9	60
1890-1899	336	58	31	11	65
1900-1913	424	57	26	17	69
1914-1919	1176	41	9	50	187
1920-1931	538	92	17	(-) 9	88
1932-1933	673	67	11	22	112
<i>Averages</i>					
1877-1913	364	60	33	7	65
1914-1933	733	69	14	17	120
1877-1933	494	66	20	14	84

The table indicates that while the net output per acre and per worker has increased considerably over the period, the proportion and amount accruing to the landlord has declined consistently, that absorbed by labour has tended to rise, while the occupier's share has fluctuated markedly and erratically.

433* GRAVES, P. E.

"A Tentative Method of Estimating Net Farm Incomes."

Econ. J. 1935, 45, 784-789.

Changes in official price indices and in estimates of gross output cannot be accepted as indicating variations in farmers' net returns. An index of net returns would, however, be of considerable interest, and this investigation aims primarily at exploring the possibilities of computing such a figure. The data employed refer only to the Eastern Counties Province, and the survey material collected during 1931-33 has been used as a check on the accuracy of the method. The basic data consist of the average composition of gross incomes and expenditures at a given year. Quantitative changes in production and requirements in the ensuing years are adequately weighted and combined with changes in unit prices and costs. Although the experimental estimates agree very closely with the ascertained results as shown by the provincial survey, the method of calculation is still unavoidably rather crude in some details, and at present can only be considered as of a tentative nature.

GRAVES, P. E.

"A Comparison of the Financial Returns of Owner-Occupier and Tenant Farmers."

Fm Econ. 1935, 1, 246-247.

The data are based on a survey of agriculture carried out in the Eastern Counties of England in 1932, which provides a sample of 995 holdings, of which roughly two-thirds are tenancies and one-third are ownerships. It does not appear that type of occupation is in itself related to profitability, but owner-occupation tends to be more widespread in areas which have suffered most in the recent depression, while the age of owner-occupiers is appreciably greater than that of tenants.

GRAVES, P. E.

"The Trend of Milk Prices in the Eastern Counties."

Fm Econ. 1936, 2, 44-46.

Figures collected during a series of economic surveys of farming conditions in the Eastern Counties suggest that the official index of the gross price of milk is now misleading as a measure of farmers' returns.

411* GRAVES, P. E. and CARSON, S. H.

"A Cost Index for Miscellaneous Farm Expenses."

J. Minist. Agric. 1935, 42, 745-749.

While official cost indices for the major farm requirements of labour, feeding stuffs, etc., are available, little is known of the relative prices of and outlay on the numerous small miscellaneous expenses which farmers necessarily incur, and which in the aggregate probably amount to a sum equivalent to one-third of the wage bill of the industry. Enquiries put to a large number of firms and agencies show that the prices of these items range up to double their pre-war level, but that owing to quantitative variations a composite index for the outlay per farm in the Eastern Counties is now approximately 156, compared with 100 in 1913.

MACGREGOR, J. J.

"The Pattern of Estate Ownership in Cambridgeshire."

Fm Econ. 1935, 1, 251-253.

This note, part of a larger study, draws attention to the uneconomic lay-out of many ownerships.

MENZIES-KITCHIN, A. W.

"Land Settlement."

A report prepared for the Carnegie United Kingdom Trustees. Pp. xvi + 175. Edinburgh, 1935.

This is an investigation into the possibilities of land settlement in Britain, mainly from the viewpoint of the unemployment problem.

After dealing with certain broad considerations of a social and economic character that have a bearing on land settlement policy—increased world production of agricultural products, technical progress, the declining trend of population, all of which tend to encourage the belief that fewer men and not more will be required on the land—the Report goes on to deal with economic considerations. It gives statistical tables of numbers of persons engaged in agriculture, numbers of wage earners, agricultural output, area under agriculture, size and distribution of holdings, and deals briefly with the questions of the balance of trade and agricultural co-operation.

It then summarises land settlement legislation in Great Britain, Germany, Denmark, and Holland, and gives a brief review of the organisation and condition of small holdings in various parts of the country. In two chapters it analyses the production and market position of those commodities—vegetables, pigs, and poultry—which are considered most suitable for production on the small farm. These chapters also deal with the 'survival' value of different types of small holdings. A further chapter considers the possibility of evolving an organisation capable of securing for the small holding some of the advantages generally claimed for large units of production, and a final chapter deals with what are variously called part-time, subsistence, supplementary, or accessory holdings, and describes this movement in the U.S.A., Germany, and Great Britain.

From the evidence available the opinion is formed that under existing economic conditions settlement on the land offers little hope of creating new employment. It is more likely to lead to a displacement of labour elsewhere and/or a general reduction in the standard of living of those already engaged in the industry. It is pointed out that the restriction of agricultural imports which will be necessary to support a land settlement policy will lead to a decline in exports and increased unemployment mainly in the distressed areas. Further, the small holding is considered unlikely to survive in competition with larger and more efficient units of production—the 3-5 acre specialist or semi-specialist holding being particularly unstable, as a result of its almost complete dependence on the world price of feeding stuffs.

With regard to the possibility of increasing the production of market garden and glasshouse produce, of eggs, and of poultry, i.e. the commodities most suitable for production on the small holding, the prospects are unpromising. It is argued that low cereal prices have compelled and will continue to compel the large farmer to enter more and more into vegetable production, and that the advance of mechanisation will rapidly enable him to undersell the small producer. It is also pointed out that in pig and poultry production the small man appears to have no real advantage.

Finally the Report emphasises the desirability of establishing part-time holdings for industrial workers and the unemployed, and discusses the very material and psychological benefits which can be derived from holdings of this type.

412* MENZIES-KITCHIN, A. W.

"Land Settlement and Unemployment."

Proc. Agric. Econ. Soc. 1936, 4, 135-149.

A consideration of the factors which militate against the success of a Land Settlement Policy in this country, with a plea for subsistence and supplementary holdings as part of a social service scheme for the unemployed.

405* MENZIES-KITCHIN, A. W.

"The Future of Land Settlement."

Garvin's Gaz. 1936.

A broad analysis of the social and economic issues which must materially influence the success of land settlement.

MENZIES-KITCHIN, A. W.

"Pig Production Costs in Denmark."

Fm Econ. 1936, 2, 25-27.

A short note on the cost of producing pigs in Denmark for the years 1932-33 and 1933-34. As a result of British quota policy the average number of pigs raised per holding fell from 138 in 1932-33 to 102 in 1933-34, while the price of bacon pigs sold under permit rose from 0.98 Kr. per Kg. dead-weight to 1.41 Kr. In spite of a slight rise in costs the net profit per pig in 1933-34 was 23.86 Kr. against 14.31 Kr. in the previous year. Over a seventeen year period an average of about 5 lb. of meal equivalent (including meal fed to breeding stock) was required to produce 1 lb. live-weight gain in a 90 Kg. bacon pig.

VENN, J. A.

"Financial and Economic Results of State Control in Agriculture."

Econ. J. 1935, 45, 649-662.

Scot. J. Agric. 1936, 19, 1-14.

Reproductions of a paper read before the British Association at Norwich, 1935, and summarised in Memoir No. 7, pp. 19-20 (Reprint 372).

OTHER PAPERS.

CARSLAW, R. MCG.

"Memorandum on Farming Conditions in the Eastern Counties of England."

Min. Evid. Roy. Comm. Rentcharge. 1935, 20, 607-614.

PETTIT, G. H. N.

"Food Costs in Milk Production."

Fmr and Stk-Breed. 1936, 50, 643.

PETTIT, G. H. N.

"Herd Depreciation Costs in Milk Production."

Fmr and Stk-Breed. 1936, 50, 774.

PETTIT, G. H. N.

"Labour Costs in Milk Production."

Fmr and Stk-Breed. 1936, 50, 1011.

AGRICULTURAL ZOOLOGY (including ENTOMOLOGY).

392* MELLOR, J. E. M. and WOODMAN, R. M.

"A Note on Preliminary Work on Attractants for Cabbage Root Fly (*Hylemyia (Chortophila) brassicae* Bche.) and Carrot Fly (*Psila rosae* L.).

Ent. Mon. Mag. 1935, **71**, 258-259.

Brewers' yeast was found to attract the cabbage-root fly and the corn-seed maggot. Hexachlorethane was chemotropic to *Anthomyia pluvialis*.

421* PETHERBRIDGE, F. R. and MELLOR, J. E. M.

"Observations on the Life History and Control of the Cabbage Aphid, *Brevicoryne brassicae* L.

Ann. Appl. Biol. 1936, **23**, 329-341.

An account is given of the study of the life history of *Brevicoryne brassicae* L. in the market garden areas of Bedfordshire, Cambridgeshire and Huntingdonshire.

It is shown that overwintering takes place chiefly as eggs on cultivated cruciferous crops (and particularly Brussels sprouts). It is suggested that control measures should aim at preventing the aphides from passing from old plants to newly planted ones. Nicotine sprays or nicotine dusts are suitable for this purpose. The pest is difficult to control on ordinary field crops.

Predators and parasites were fairly abundant, but not sufficiently so to prevent serious damage.

PETHERBRIDGE, F. R. and STAPLEY, J. H.

"Survey of the Pests of Sugar Beet in England during 1935."

Paper No. 52. *Minist. Agric. Fish. Sugar Beet Res. and Educ. Comm.*

(Not available for general circulation).

In 1935 adverse weather conditions early in the season influenced the abnormal amount of insect damage. Hemiptera proved of little importance as pests except *Aphis rumicis* (*A. fabae*) which was common in the west. The only important Lepidopterous pest was the cutworm of which several species were probably involved. Of the beetles *Atomaria linearis* was particularly prevalent in the Eastern Counties. Wireworms were well distributed and of general occurrence. Some damage by chafer beetle larvae was recorded. An account is given of the trouble called "Strangle," evidence being produced to show that insects under suspicion were not connected with it. Millipedes were sometimes injurious. The eelworm "*Heterodera schachtii*" caused beet-sickness on land that had been cropped too frequently with beet and mangolds. Although viable eelworm cysts were found at eight factories, it could not be stated that the cysts found were those of the sugar beet strain.

434* PETHERBRIDGE, F. R. and THOMAS, I.

"The Common Rustic Moth, *Apamea (Hadena) secalis* L., Attacking Winter Cereals."

Ann. Appl. Biol. 1936, **23**, 649-652.

This is the first record of serious damage to winter cereals by the larva of the Common Rustic Moth (*Apamea secalis* L.). In February and March 1934 wheat on two farms in West Norfolk was ruined by the attack of this pest. Normally the caterpillar lives in grasses and it is probable that the moths had laid their eggs in the grasses of the leys which preceded the wheat. In 1935 it was reported that a 12 acre field of wheat in Suffolk was also ruined by this pest.

PETHERBRIDGE, F. R. and THOMAS, I.

"The Control of Plum Sawfly (with a note on Thrips damage)."
J. Minist. Agric. 1936, **42**, 1108-1118.

The results of three years' experiments in the Eastern Counties show that a good control of plum sawfly can be obtained by spraying with a Derris wash. When the infestation is likely to be severe, two applications of the wash should be made, the first after blossoming, when the receptacles (cots) are beginning to split, and the second a week later. A spray containing nicotine sulphate and lead arsenate also gave good results. Nicotine sulphate alone gave only a moderate control and the results from lead arsenate alone were poor. One dusting with a Derris dust was not satisfactory. Three dustings with a 30 per cent. naphthalene dust reduced the infestation but, as this does not kill, it probably drives the sawflies to other trees.

435* PETHERBRIDGE, F. R. and THOMAS, I.

"Damage to Wheat by *Helophorus nubilus* F."
Ann. Appl. Biol. 1936, **23**, 640-648.

The larva of the beetle *Helophorus nubilus* F. is recorded as a serious pest of wheat in East Anglia. No previous record of serious damage has been made, but slight injury was recorded in 1922 and 1923. Observations in a number of widely separated fields show that the intensity of attack varies with the previous cropping and a serious attack occurs most frequently after rye grass and clover. The larva causes most damage when the tilth is loose.

Observations on the life history suggest that the species has one generation per annum. Eggs were not found, and the earliest damage to wheat was observed in January. Pupae were found in late April and early May, and adults were bred out in the laboratory at the end of May. The larval and pupal stages are described.

PETHERBRIDGE, F. R. and THOMAS, I.

"Further Experiments on the Control of Flea Beetles in Seed-beds."
J. Minist. Agric. 1936, **42**, 1086-1088.

Further experiments in Bedfordshire show that flea beetles attacking *Brassicae* seed-beds can be satisfactorily controlled with either Derris or naphthalene-silica dusts. Powdered quartz gave some measure of protection but the use of this dust cannot be recommended.

As a result of these and previous experiments* the following recommendations are made :—

1. Prepare as fine a tilth as possible.
2. Dust with a Derris or naphthalene-silica dust as the plants are coming through the ground.
3. Subsequently, dust at intervals depending on the weather and extent of attack.
4. *Keep a very careful watch on the seed-beds.* (During fine weather they should be examined twice a day).

*See Memoir No. 7, p. 20.

436* THOMAS, I.

"On the Occurrence in England of the Pear Fruit Saw-fly, *Hoplocampa brevis* Klug."

Ann. Appl. Biol. 1936, **23**, 633-639.

Larvae of *Hoplocampa brevis* Klug., the pear fruit saw-fly, have been found attacking pears in two gardens in Cambridge. In some continental countries this is a serious pest of pears; this is the first record of damage by this pest in England.

A preliminary study of the biology of this species has been made, and the egg, larval stages and cocoon have been briefly described.

OTHER PAPERS.

WARBURTON, C.

"Annual Report for 1935 of the Zoologist."

J. R. Agric. Soc. 1935, **96**, 499-506.

ANIMAL BREEDING AND GENETICS.

399* HAMMOND J. and MANSFIELD, W. S.

"Investigations on Producing Quality in Beef."

J. Minist. Agric. 1936, **42**, 977-985.

Repr. in *Manx J. Agric.* 1936, **3**, (No. 2) 13-23.

A beef production experiment in which Irish Shorthorn heifers were crossed with bulls of different beef breeds is described. The progeny, at 16 months old when they weighed 900 lbs. were marketed through the Ministry's Marketing Scheme for Livestock. The various factors which go to make up quality in the carcass, such as Carcass Percentage, Carcass Weight, Proportions of the Carcass, "Grain", "Finish", Colour of the Fat, and Colour of the Flesh are described and illustrated. It is suggested that the Ministry's Marketing Scheme might be used to co-ordinate tests for quality in beef production experiments made by Agricultural Colleges. It is also suggested that in order to encourage the production of high quality beef the Cattle Subsidy should be given on a sliding scale according to weight and quality.

HAMMOND, J.

"New Science in Stock-Breeding."

Fmrs Wkly. 1936, **4**, (No. 16) 15.

A popular account of the recent and present work and aims of the Physiological Section of the Animal Nutrition Institute.

PEASE, M. S.

"Auto Sex-Linkage in Theory and Practice."

Rep. VIth World's Poult. Congr., Berlin-Leipzig. 1936, **2**, 65-69.

A discussion of the bearing of auto sex-linkage on Fisher's theory of dominance in poultry.

448* PUNNETT, R. C.

"The Experiments of T. H. Riches Concerning the Production of Monsters in Cattle."

J. Gen. 1936, **32**, 65-72.

Monstrous calves due to the operation of a lethal factor have long been known

to appear as the result of mating Dexter cattle together. A similar type of monster, though rather less marked, has been met with in Norwegian Telemark cattle. Its appearance is also due to the operation of a lethal factor. The experiments recorded show that these two lethals are genetically independent.

A few observations on the inheritance of colour and of the white pattern of Telemark cattle tend to confirm the results of earlier observers.

OTHER PAPERS.

EDWARDS, J.

"A Friesland Breeding System."

Brit. Fries. J. 1935, 17, 712-713.

EDWARDS, J.

"Old Ideas of Pedigree Must Go."

Fmr's Wkly. 1935, 3, (No. 16), 15.

EDWARDS, J.

"A New Source of National Wealth."

Dairy Short. J. 1935, 4, 387-388.

409* HAMMOND, J.

"When Cows Do Not Breed."

Fmr and Stk-Breed. 1936, 50, 845.

PEASE, M. S.

"Founding a New Strain of Poultry."

Feath. World. 1935, p. 648.

PEASE, M. S.

"Mendelism and the Fancy."

Rep. 7th Rabbit Breed. Conf., Harper Adams Agric. Coll., Aug. 1935.

PEASE, M. S.

"The Principle of Auto Sex-Linkage."

Rep. Proc. 12th Annu. Conf. Poult. Instr. Oct. 1935, pp. 9-12.

422* WALTON, A.

"Artificial Insemination Applied to Dairy Husbandry."

Rep. Cent. Coun. Milk Rec. Soc. 1935, pp. 50-55.

423* WALTON, A.

"The Use of Artificial Insemination."

Fmr and Stk-Breed. 1936, 50, 1550.

ANIMAL NUTRITION.

428* HALNAN, E. T.

"The Rôle of Minerals in Poultry Nutrition."

Rep. VIIth World's Poult. Congr., Berlin-Leipzig. 1936, 1, 53-64.

Contains a summary of the existing knowledge on the part played by mineral salts in growth production and egg production. The main points emphasized are: The ash percentage composition of the bird rises rapidly in the first few weeks of the chicks life, pathological conditions arising from errors of mineral metabolism therefore become evident during this period.

Ash deposition in the body is rapid from 8 weeks upwards, indicating the need for inclusion of mineral supplements in chick dietaries at this stage of the chick's growth. For growth purposes, the inclusion of sodium chloride in a chick's dietary is shown to give beneficial results, and the desirability of the addition of a calcium salt indicated.

For egg production, the limiting mineral factors are shown to be sodium, chlorine and calcium, and experimental evidence is adduced showing improved egg production following the use of sodium chloride and calcium salts as mineral supplements.

438* MANSFIELD, W. S. and TREHANE, W. R.

"Interim Report of Pig Feeding Experiment Conducted on the Cambridge University Farm during 1935."

J. R. Agric. Soc. 1935, **96**, 137-148.

Twenty pairs (litter brother and litter sister) of Large White pigs were fed individually from the age of ten weeks to bacon weight. One of each pair was fed to appetite, its mate being fed on a restricted quantity of the same ration. As bacon weight was reached the pigs were sent to the bacon factory and the carcasses were measured. In spite of the fact that the pigs on the restricted ration took on an average one month longer to arrive at bacon weight yet they consumed .32 lbs. of food less per lb. of live-weight gain than those fed to appetite. The grading of the restricted pigs was significantly better.

390* WOODMAN, H. E.

"Pasture Research at Cambridge During the Last Decade."

Sch. Sci. Rev. 1935, **17**, 107-114, 256-264.

These articles give a complete and concise summary of the pasture investigations carried out at Cambridge in recent years, and contain sections under the following headings: (1) Aim and scope of investigations; (2) continuous close-grazing; (3) rotational close-grazing; (4) extensive grazing; (5) the conservation of the produce of pastures (grass-drying); (6) the feeding value of winter pasturage; (7) the utilization of young grass by swine.

383a* WOODMAN, H. E. and EVANS, R. E.

"Nutritive Value of Lucerne. IV. The Leaf-Stem Ratio."

J. Agric. Sci. 1935, **25**, 578-597.

In this publication, which brings to a close the account of the Cambridge investigations into the nutritive properties of the lucerne crop as grown under English conditions, are brought together the numerous data that have been accumulated during the course of the work concerning the ratio of the amount of leaf to a stem in lucerne at different stages of growth, and the separate composition of the leafy and stemmy fractions.

The problem of the leaf-stem ratio in relation to variety has also been studied, since manifestly, other factors being equal, the variety of lucerne to be preferred is that which yields the highest weight of leaf per unit weight of crop.

Various questions relating to the conservation of lucerne by artificial drying are discussed in the light of the results of the lucerne investigations.

406* WOODMAN, H. E., EVANS, R. E., and EDEN, A.

"The Composition and Nutritive Value of Marrow Stem Kale and Thousand Head Kale."

J. Agric. Sci. 1936, **26**, 212-238.

The results of the trials reveal a close agreement between the starch equivalent, per 100 lb. of dry matter, of the kales and of swedes. One ton of the dry matter in either marrow stem or thousand head kale is very nearly equal in starch equivalent to 1 ton of the dry matter in swedes. When therefore, a swede crop has the high dry matter content of about 14 per cent., 1 ton of swede may be taken as containing as much starch equivalent as 1 ton of marrow stem kale, but in the case of swedes of lower dry matter content, the advantage lies with the kale. For example, 1 ton of marrow stem kale (containing 13.8 per cent of dry matter) supplies as much starch equivalent as about $1\frac{1}{5}$ tons of swedes (containing 11.5 per cent. of dry matter), while 1 ton of thousand head kale (containing 15.8 per cent. of dry matter) is equal, from the starch equivalent standpoint, to about $1\frac{1}{3}$ tons of such swedes.

As a source of protein and minerals, the kales are very much superior to swedes. Both kales are extremely rich in mineral matter, the latter being distinguished by its richness in lime, chlorine, potash and sulphur. Satisfactory amounts of phosphoric acid, iron and magnesia are also present.

It is shown that more than half of the dry matter in the marrow from the stems is composed of a mixture of invert sugar and sucrose. The marrow from thin as well as thick stems of marrow stem kale, and also from the stems of thousand head kale, displayed this sugar-rich character.

WOOD, T. B. and WOODMAN, H. E.

"Rations for Live Stock." 9th ed. rev. by H. E. Woodman.

Bull. 48, *Minist. Agric. and Fish.*, 1936. (H.M.S.O., London. Price 1s. 2d. Post Free).

OTHER PAPERS.

CRUICKSHANK, E. M.

"The Achievements of Scientific Research."

Poult. World Annu. 1936, pp. 17-19.

EDWARDS, J.

"Feeding for Fat Per Cent."

Rep. Cent. Coun. Milk Rec. Soc. 1935, pp. 41-45.

EDWARDS, J.

"Pig Research at Cambridge, 1934-36."

Pig Breed. Annu. 1936-37, **16**, 117-120.

456* EDWARDS, J.

"Indigestion and Fat Per Cent."

Cambs Milk Rec. Soc. Yearb. 1936, pp. 23-24.

HANLEY, F.

"Uncommon Feeding Stuffs."

Husbandry. 1936, **6**, 6-9, 39-40, 82-84.

WOODMAN, H. E.

"What Roots are Worth."

Fmrs' Wkly. 1935, **3**, (No. 23), 27.

WOODMAN, H. E.

"The Function and Sources of Vitamins."

Fmrs' Wkly. 1936, 4, (No. 11), 24.

WOODMAN, H. E.

"Young Grass Makes the Best Hay."

Fmrs' Wkly. 1936, 4, (No. 19), 24.

ANIMAL PHYSIOLOGY.

407* GARNER, F. H., and SANDERS, H. G.

"The Effects of Different Methods of Castration and Docking on the Growth of Lambs."

J. Agric. Sci. 1936, 26, 296-300.

Two methods of castrating male lambs have been compared—the Burdizzo and knife methods. No difference was found in subsequent growth rate.

Two methods of docking male and female lambs have also been compared—searing and crushing with the Burdizzo. No difference was found in subsequent growth rate.

There was a tendency for ram lambs to have a higher initial weight than ewe lambs, and their rate of growth between the ages of 2 and 10 weeks was definitely greater than that of ewe lambs.

418* HAMMOND, J.

"The Physiology of Milk and Butter Fat Secretion. I. Milk Pressure in the Udder."

Vet. Rec. 1936, 16, 519-527.

The causes and effects of milk pressure in the udder are of fundamental importance in explaining the physiology of milk and butter fat secretion.

The whole structure of the cow's udder appears to be designed for the relief of pressure on the secreting cells.

It is suggested that the "letting down" of milk is an active process brought about by a reflex causing erection of the udder and so pressure on the milk contained in the ducts.

Increase of milk pressure slows down the rate of milk secretion and eventually stops it. The ways in which increased milk pressure affects, and is affected by, the structure of the udder are discussed.

It is suggested that differences in the fat percentage of the milk are caused by milk pressure (*a*) through inhibition of the actual secretory process and (*b*) by affecting the ease with which the fat globules pass down the capillary ducts to the cistern from which they can be withdrawn.

418* HAMMOND, J.

"The Physiology of Milk and Butter Fat Secretion. II. The Development and Evolution of Milk Composition."

Vet. Rec. 1936, 16, 528-535.

A parallel can be drawn between the changes in the development of the composition of milk in the individual and the changes that have taken place during the course of evolution in different species.

As globulin and albumin are formed first during the inception of lactation in the cow and other species, the changes in the proportions of the other constituents are considered in relation to the amount of these substances present in the milk.

During the course of the development of milk secretion in the cow there are uniform and well defined changes in chemical composition ; as the rate of secretion increases the percentage of globulin and albumin decreases and the proportions of water, lactose, casein and ash rise. The proportion of lactose increases at a faster rate than the casein.

When the composition of the milks of different species is considered in the same way it is evident that these milks (with few exceptions) have much the same proportional compositions as those of cows' milk during the course of development at similar globulin and albumin content levels. Moreover the lactose increases at a greater rate than the casein in the milks of different species as the globulin and albumin content of the milk falls.

443* HAMMOND, J.

"Pregnancy in the Rabbit."

Rep. VIth World's Poult. Congr. Berlin-Leipzig. 1936, 1, 153-156.

A knowledge of the changes occurring in the reproductive organs during pregnancy is necessary if science is to assist the breeder in the production of strong healthy young.

Conception. The eggs are fertilized at the top of the tubes about 14 hours after mating. Progesterin, secreted by the corpora lutea, is necessary for the formation and continuance of the maternal placenta.

Changes in the Reproductive Organs. The maternal placenta increases only to the 16th day, while the foetal placenta increases to the end. As progesterin secretion wanes towards the end of pregnancy the maternal placenta is loosened from the uterus and the foetal and maternal placentas become firmly attached together. The foetal fluids increase to the 24th day and then are absorbed by the foetus : if an embryo dies its fluids are not absorbed. A uterine horn can grow to accommodate double the number of young it usually contains, so uterine accommodation does not limit the size of the young. The vagina grows considerably after the 24th day ; development of its lumen by growth is necessary for easy birth. Feeding affects the rate and extent of the development of the mammary gland and so the amount of milk available for the young after birth. The foetus grows little until towards the end of pregnancy. The size of the young is controlled more by internal secretions of the mother than by the feed. By reducing the number of eggs fertilized to one or two, young of double the normal weight are produced. The sex can be determined at birth.

Diagnosis of pregnancy may be made by the thickness of the mammary gland and by abdominal palpation.

The duration of pregnancy increases with the size of the breed and with reduction in the number in the litter.

384* HIRZEL, R.

"Note on the Effect of Condition on the Colour of Body Fat in Rabbits."

J. Agric. Sci. 1935, 25, 541-544.

The tentative conclusion suggested by these results is that in fattening, a proportion of the ingested pigment is laid down in the fat, but that when such fat is used for body maintenance the pigment is not wholly reabsorbed but concentrated in the fatty tissue, thereby deepening the colour.

The results given here are only preliminary experiments and are now reported because owing to the author's return to South Africa the work had to be discontinued. It requires to be extended under conditions where the fat colour can be tested more accurately. Nevertheless, the results suggest an explanation for the fact that the fat colour in old cows and steers which have undergone seasonal fluctuations in condition is usually a darker tint than in young heifers and steers which have fattened steadily, and that animals once fat and killed in poor condition are usually darker in colour than fat ones.

MARSHALL, F. H. A.

"Sexual Periodicity and the Causes which Determine It."

Nature. 1936, **137**, 1056-1057.

Substance of the Croonian Lecture delivered before the Royal Society on June 18th, 1936.

441* MARSHALL, F. H. A. and VERNEY, E. B.

"The Occurrence of Ovulation and Pseudo-pregnancy in the Rabbit as a Result of Central Nervous Stimulation."

J. Physiol. 1936, **86**, 327-336.

Ovulation has been produced in the rabbit on heat by electrical stimulation of the central nervous system.

Ovulation occurred irrespective of whether the stimulus was applied through the brain or through the lumbo-sacral part of the cord.

The period between stimulus and ovulation varied from 17 to 24 hours. It was thus from 7 to 14 hours longer than that between normal coitus and ovulation.

Pseudo-pregnancy supervened in four rabbits which were kept alive, two for 7 days and two for 14 days, after the electrical stimulus had been applied.

The facts are discussed in the light of the view that the effects of the stimulus are produced through the mediation of the anterior pituitary body.

393* WHETHAM, E. O. and HAMMOND, J.

"Factors Affecting Milk and Butterfat Secretion. I. Variations in Fat Weight, Fat Percentage, and the Amount of Fat in the Milk Required to Make a Given Weight of Butter."

J. Dairy Res. 1936, **6**, 320-339.

The ratio of the weight of fat in the milk required to make 1 lb. of butter has been taken to indicate the size of the fat globule in the milk, and so the type of "cream line" produced.

The Dairy Show records have been analysed from this standpoint, and variations in the above ratio studied together with variations in milk yield, fat yield and fat percentage. The effects considered are those between breeds and within breeds, the latter including milk yield, period of lactation and age of cow.

With a constant milk yield the fat percentage does vary between breeds, but not to the same extent as it does when no account is taken of the differences in average yield of the different breeds; the same applies to the fat : butter ratio, *i.e.* size of fat globule. The effect of equal increases of milk yield on the butter : fat ratio is much greater between breeds than it is within any one breed.

It is suggested that the size of the fat globule is determined by two factors : (a) the rate of butterfat formation by the cell, which varies with breed and stage of lactation, and (b) the rate of milk secretion which affects the size of the globules by the rate at which they are washed out from the cell.

Regression lines of fat yield, fat percentage, and fat : butter ratio on milk yield have been plotted under different circumstances affecting milk yield—between breeds, within breeds, with age, and period of lactation.

It is suggested that the changes in milk yield during the lactation period are for the most part due to changes in the rate of secretion of the cells and those due to age are for the most part due to changes in the number of cells secreting.

If this is accepted it will follow that when the yield of milk is increased by increased rate of secretion of the gland cell the percentage of fat in the milk will decrease (period of lactation), but when the yield of milk is increased by the number of cells secreting, the fat percentage in the milk will remain unchanged (age).

This might explain why sires can effect an improvement or otherwise in milk yield in conjunction with, or independently of fat yield ; in other words, milk yield can be affected (a) by an increase in the number of cells, in which case fat yields are also increased although the fat percentage remains the same, or (b) by an increase in the rate of milk secretion, in which case the fat percentage is reduced.

393* WHETHAM, E. O. and HAMMOND, J.

“ Factors Affecting Milk and Butterfat Secretion. II. The Colour of the Butterfat.”

J. Dairy Res. 1936, 6, 340–352.

The colour of the butter for individual cows at the London Dairy Show have been measured on a colour scale of yellow shades on cellulose strips, and the results analysed statistically.

The mean values and variability curves of the ranges of butter colour in the different breeds of dairy cattle are given. Circumstances which may affect these values are indicated.

The two most important factors affecting butter colour are the genetic character of the cow and the method of feeding.

A slight increase in the shade of colour was found to occur under most of the various conditions which give rise to increased milk yield. It is suggested that this may be due to the greater intake of colouring matter (associated with the greater food intake) in proportion to butterfat produced, since increase in yield is usually associated with decrease in fat percentage.

The colour is high in the first few weeks of lactation and falls gradually as more fat is required from the body in addition to that from the food. After about 180 days the colour rises again as the butter yield falls and more of the fat is supplied by the food intake. It is suggested that butterfat derived from body fat will be paler than that from food fat, when the latter is sufficiently provided with plant pigments, because when fat is withdrawn from the body cells the pigment is partially retained and becomes concentrated in them.

OTHER PAPERS.

GARNER, F. H. and SANDERS, H. G.

“ Docking and Castrating.”

Fmr and Sk-Breed. 1936, 50, 248.

HALNAN, E. T.

"Egg Defects and their Causes."

Rep. Proc. 12th Annu. Conf. Poult. Instr. Oct. 1935, pp. 16-22.

HALNAN, E. T.

"The Nature and Cause of Faulty Eggs."

4th Beds Poult. Soc. Yearb. 1936, pp. 43-46.

ANIMAL PRODUCTION.

442* DAVIDSON, H. R., HAMMOND, J., SWAIN, J. B., and WRIGHT, N. L.

"A Method for Judging Pork and Bacon Carcasses."

Pig Breed. Annu. 1936-37, 16, 49-64.

A scale of points has been drawn up; these are mainly by measurement, but where this is not possible (hams, shoulders, streak) photographic scales have been produced to standardize judging. Tables for converting measurements of fat, muscle and bone in carcasses of different weights to marks are given. These show the requirements of the London trade. The object of the method is to form a means of detailing to the producer how far the carcasses he is producing are meeting the public requirements.

GARNER, F. H.

"Butter Fat Recording."

Cambs Milk Rec. Soc. Yearb. 1936, pp. 51-54. (Reprinted in several other Milk Rec. Soc. Year Books.)

The Ministry's butter-fat recording scheme is not receiving the support it deserves: this may be because the scheme is not fully understood and an attempt has been made to explain the scheme briefly. The cost of butter-fat recording is low per cow, being only 3s. 4d. to 8s. above the cost of milk recording. The advantages of butter-fat recording have been explained both for the pedigree and non-pedigree breeder; it would appear that, for the small sum mentioned above, it should be a sound procedure to record officially the butter-fat production of cows. As butter-fat recording is an adjunct to milk-recording it can only be carried out through a Milk Recording Society.

401* HAMMOND, J.

"The Problem of Quality in Relation to Meat Production."

Scot. J. Agric. 1936, 19, 24-28.

Paper read before the British Association at Norwich and summarized in Memoir No. 7, p. 34.

OTHER PAPERS.

EDWARDS, J.

"Efficiency in Dairy Cows."

Fmr and Slt-Breed. 1936, 50, 943.

Repr. in *Ayrsh. Cattle Soc. J.* 1936, 8, 67-69.

HAMMOND, J.

"Judging of Bacon by a Standardised Chart of Measurements."

Emp. Pork Rev. 1935, pp. 10-11.

Repr. in *N.Z. Fmr.* 1936, 57, 481.

ESTATE MANAGEMENT.

DEAN, N.

"The Teaching of Estate Management at Cambridge University."

J. Chart. Surv. Instn. 1936, 16, 95-111.

The aim of the courses and examination leading to the B.A. degree in Estate Management is to impart a knowledge of building construction, the legal principles incidental to land ownership, agricultural valuations and the science and practice as well as the history and economics of Agriculture and Forestry. As a result of experience, a new syllabus is coming into force in October, 1936, designed to strengthen the teaching of the fundamental subjects of Agriculture, Law and Economics upon which Estate Management teaching is based.

The obvious value to practising surveyors of the close connection between teaching and practical work provided through the work done by the Estate Management Branch for the University and College estates is indicated.

The need for research work in Agriculture also applies to Estate Management which has its own particular problems and much useful research work might be carried out by post-graduate students intending to make Estate Management their career.

The author discussed at length the university academic system of the twelfth century, and of to-day, with special reference to the life of the present-day student reading Estate Management.

419* WELLER, E. P.

"Investment Companies and Rural Land."

J. Chart. Surv. Instn. 1936, 15, 126-150, 156-175.

The paper and discussion explored the possibilities of the ownership of large blocks of rural land by investment companies as a means of replacing the landlords' capital, which is being withdrawn by the sale of private estates, and of securing the advantages of large-scale management of estates. These are the lines on which industry is moving, and in this way the best features of the landlord and tenant system might be preserved as an alternative to occupying ownership on the one hand or State ownership on the other. Some of the capital now seeking investment could be brought into the land, where it is badly needed for replanning, reconditioning, and re-equipment. Adequate capital and continuity of policy on large areas would give opportunities for efficient management by first-class administrative and specialist staffs, and the prospects of able men in the land management profession would be improved. For various reasons, which were reviewed in the paper, present notions of land values might make it difficult to acquire suitable areas at prices which would yield an adequate return, but future tendencies may remedy this. Even at present prices, increased rental values and reduced costs resulting from efficient capitalisation and management might raise the net income to a satisfactory level, or the issue of mortgage debenture stock at a comparatively low rate of interest might leave a fair yield on the equity.

FORESTRY.

378* THOMPSON, C. H.

"Pruning."

Quart. J. For. 1935, 29, 256-260

A summary of a bulletin issued by the Yale University School of Forestry on the subject of pruning in coniferous woodlands. Principles and practice are dealt with, but emphasis is laid on the conclusion that for high pruning the ladder and hand saw are preferable to the pole-saw.

THOMPSON, C. H.

“Royal English Forestry Society’s Report on the ‘Annual Excursion of the Society to Kelso, 2nd–5th September, 1935’.”

Quart. J. For. 1936, **30**, 68–92.

Discusses the main silvicultural features and problems encountered in the woodlands of the five estates visited.

PLANT BREEDING AND GENETICS.

BELL, G. D. H.

“Crops and Plant Breeding.”

Fmrs’ Guide Agric. Res. 1934.

J. R. Agric. Soc. 1935, **96**, 159–199.

Considerable space is devoted to an account of certain aspects of grassland research such as the improvement of herbage plants, the behaviour of species and strains and the effect of grazing on the botanical composition.

The physiological and practical significance of winter hardiness and drought resistance are discussed in relation to the plant’s growing conditions, and an attempt is made to associate these two important characters with other plant characters.

Recent tendencies in oat-breeding in the British Isles with a description of the new varieties are the subject of the concluding section, while a bibliography of seventy-six references is appended.

PAL, B. P.

“Hybrid Vigour in Wheat.”

Indian J. Agric. Sci. 1935, **5**, 693–704.

A summary of the original paper by Engledow and Pal in the *Journal of Agricultural Science*. 1934, **24**, 390–409, summarised in Memoir No. 7, pp. 37–38 (Reprint 323).

SALAMAN, R. N.

“A Discussion on the Present State of The Theory of Natural Selection.”

Proc. Roy. Soc. Ser. ‘B.’ 1936, **121**, 72.

Examples from the writer’s observation on the presence of immunity to fungoid diseases in plants which are not subjected to the same in their own habitat.

WATKINS, A. E.

“Heredity and Evolution.”

Pp. viii + 243, with 25 Figs. and 2 Pls.

John Murray, London, 1935. Price 7s. 6d. net.

In this book, the principles of genetical sciences, their scope and the evidence on which they rest have been discussed, the bearing of these principles on the theory of evolution being kept in view throughout. Illustrations likely to be familiar to those with little biological knowledge have been given whenever possible.

OTHER PAPERS.

HUDSON, P. S.

"Plant Breeding in Great Britain."

Int. Congr. Plant Breeders, Netherlands, June, 1936, pp. 77-78.

SALAMAN, R. N.

"Recent Work on Potato Breeding in Great Britain."

Int. Congr. Plant Breeders, Netherlands, June, 1936, pp. 78-80.

SALAMAN, R. N.

"Report of the Potato Synonym Committee, 1934."

J. Nat. Inst. Agric. Bot. 1936, **4**, (No. 1), 52-56.

PLANT PATHOLOGY.

381* BAWDEN, F. C.

"The Relationship Between the Serological Reactions and the Infectivity of Potato Virus 'X'."

Brit. J. Exp. Zool. 1935, **16**, 435-443.

A close relationship exists between the antigen content of purified suspensions of the S strain of potato virus "X", as measured by their optimal flocculation point with antisera, and their virus content as measured by the local lesion method. The strengths of such suspensions were found to lie in the same order when compared by both methods. The relationship was found to hold only when the suspensions compared were prepared in the same manner.

The two methods of estimating concentration gave different results when different mixtures of strains of virus "X" were compared. Strains G and L are serologically indistinguishable from strain S, but produce no local lesions. It is suggested that the antisera provide a quantitative method of working with such viruses, and that they also afford a reliable estimate of the total virus in a mixture of strains, where the results from lesion counts would be misleading.

Inactivation of the virus by heat, ageing and alcohol was accompanied by the loss of flocculating power with antiviral sera. Inactivation by formalin left the flocculating power unimpaired, whilst inactivation by phenol greatly reduced and altered the flocculation, but did not completely destroy it. The antigen and the virus behaved similarly in their reaction to certain precipitants.

444* BAWDEN, F. C.

"The Viruses Causing Top Necrosis (Acronecrosis) of the Potato."

Ann. Appl. Biol. 1936, **23**, 487-497.

It is shown that top necrosis can be produced in different potato varieties by a number of viruses. The reactions of these viruses on a large number of commercial varieties are given, together with certain of their properties and methods by which they can be transmitted. By grafting and needle inoculating infected potatoes to the four varieties Epicure, Arran Victory, President and Up-to-Date, and noting the type of necrotic disease produced on these differential hosts, it has been found possible to distinguish with a fair degree of accuracy between six viruses. The necrotic reactions of these varieties are given below.

Virus	Needle inoculation to potato	Up-to-Date	Epicure	President	Arran Victory
"A"	—	Top necrosis	—	—	—
"B"	—	—	Top necrosis	Top necrosis	Top necrosis
"C"	—	Top necrosis	Top necrosis	Top necrosis	—
"D"	+	Top necrosis	Top necrosis	Foliar necrosis	Foliar necrosis
"X"	+	—	Top necrosis	—	—
"Y"	+	Acropetal necrosis	—	Acropetal necrosis	—

402* BAWDEN, F. C. and PIRIE, N. W.

"Experiments on the Chemical Behaviour of Potato Virus 'X'".

Brit. J. Exp. Zool. 1936, 17, 64-74.

The experiments recorded were made with purified suspensions of the S strain of potato virus "X". The method of preparing the suspensions and analyses of the material in them are given. A factor in pancreas which is soluble in petrol ether inactivated the virus. The addition of trypsin immediately reduced the infectivity without affecting the flocculating power with antiserum. Incubation with crystalline preparations of trypsin and pepsin destroyed both the infectivity and the power of reacting with antiserum. The inactivation occurred only at pHs at which the enzymes are proteolytically active, and the extent was directly proportional to the concentration of the enzyme and to the time of incubation. Papain alone and cyanide alone had no effect on the virus, but the two together inactivated it. Nitrous acid caused loss of infectivity without affecting the reactions with antiserum. The extent of the loss was proportional to the concentration of nitrous acid and to the reaction time.

424* BAWDEN, F. C., PIRIE, N. W., and SPOONER, E. T. C.

"The Production of Antisera with Suspensions of Potato Virus 'X' Inactivated by Nitrous Acid."

Brit. J. Exp. Zool. 1936, 17, 204-207.

Antisera indistinguishable from those prepared by injecting suspensions of active virus can be prepared in rabbits by the intravenous injection of suspensions of virus "X" inactivated by nitrous acid. Both fix complement and flocculate with virus suspensions, but not with the sap of healthy tobacco plants, and both are equally effective in neutralizing the virus *in vitro*.

437* BATES, G. H. and WESTON, W. A. R. DILLON.

"The Dying of the Tips of Potato Sprouts During 'Chitting'".

Sci. Hort. 1936, 4, 141-142.

It is suggested that the dying of the tips of potato sprouts during "chitting" is due to slight bruising. This condition is intensified when potatoes are chitted in low light intensities.

403* BEAUMONT, A., WESTON, W. A. R. DILLON, and WALLACE, E. R.

"Tulip Fire."

Ann. Appl. Biol. 1936, 23, 57-88.

The salient points dealing with the disease of tulip fire are discussed; its names, the various forms of the disease such as fire, spot and a rot of the bulb, the symptoms

of these, the distribution of tulip fire, its economic importance, its host specialisation and the relative susceptibility of varieties to it.

The life history of the organism causing it, *Botrytis Tulipae* (Lib.) Lind is given, and the formation, germination, viability, and development of conidia and sclerotia in natural and artificial media are discussed. Infection studies in the laboratory and field with conidia and sclerotia are described, and the meteorological factors that favour artificial or natural epidemics.

Observations and experiments dealing with control measures are given.

416* HANLEY, F. and MANN, J. C.

"The Control of Heart Rot in Sugar-Beet."

J. Minist. Agric. 1936, 43, 15-23.

Describes an experiment carried out in Norfolk in the season 1935 comparing applications of 0, 4, 14 and 28 lbs. per acre of borax for controlling heart rot in sugar beet. Application of 14 and 28 lbs. borax per acre gave satisfactory results but 4 lbs. per acre was not nearly so effective. 28 lbs. per acre proved slightly, but not significantly, better than 14 lbs. per acre both in yield of beet and sugar percentage.

445* SALAMAN, R. N.

"Immunity to Virus Diseases in Plants."

Rep. IIIrd Congr. Int. Path. Comp. Athens, 1936, pp. 167-176.

In plants, attempts to demonstrate humoral immunity against fungi, bacteria, or viruses, fail, as do attempts to transfer by graft immunity of one species to another.

Against virus diseases there exists real and apparent immunity. Two types of the latter are: one in which the plant, after initial reaction, displays no further symptom; the second, "carriers", in which there is no reaction.

Thung, 1931, described a case in which tobacco plants suffering from mosaic resisted inoculation with virulent virus. The author, 1933, demonstrated three strains of 'X' virus: one, X^o, practically symptomless on tobacco and potato. Plants infected with X^o are protected against infection with more virulent strains. Two further sub-varieties have been isolated, one, X^s, intensely virulent for potato and tobacco; X^o still protects completely. Later, others record similar protection in relation to sub-varieties of cucumber and tobacco mosaic.

Two facts emerge: protection is specific to a particular virus group; the plant contains the protecting strain, presumably in every cell. In a few cases, strictly local invasions of the virulent strain occur in protected plants; in such spots the non-virulent strain probably failed to penetrate.

The immunity conferred is cellular; its operation may be expressed: "First come, first served".

Immunity, as far as is known, depends on the existence of non-virulent sub-varieties of the invading virus. Workers with potato 'Y' virus have not produced satisfactory evidence of multiple strains. Lately the writer isolated a variety of 'Y' of lower virulence and finds it confers immunity against virulent strains.

Natural immunity to virus infection is local or general: in the former, spread of virus is inhibited by necrotic reaction at the point of entry. Such immunity can sometimes be overcome by inducing rapid growth when foci develop in the fresh shoots, becoming themselves localised by necrosis. In natural immunity apparently

the virus cannot obtain lodgement in the cells. There is no evidence of anti-bodies in juices of such plants.

Study of green veinbanding in infections with the Y or X viruses demonstrated that if more than one strain of X virus be present, that of lower virulence is concentrated in the green band. With Y infection, the central portions of the green band may be free from virus.

SALAMAN, R. N.

"Immunity to Virus Diseases in Plants."

Ind. Int. Congr. Micro-biol. London, 1936.

Same as above.

388* SMITH, K. M.

"A New Virus Disease of the Tomato."

Ann. Appl. Biol. 1935, **22**, 731-741.

A technical account is given of a new virus isolated from some tomato plants sent in by a grower. The disease produced by the virus on the tomato plant has been described. Some of the physical properties of the virus have been investigated. Its particle size has been measured and found to be from 17-25 millimicrons. This is the smallest plant virus so far described.

387* SMITH, K. M.

"New Virus Diseases of the Tomato."

J. Roy. Hort. Soc. 1935, **60**, 448-451.

An account is given of three new virus diseases of the tomato, identified during the year.

SMITH, K. M.

"The Problem of a Plant Virus Infection."

Ind. Int. Congr. Micro-biol. London, 1936.

This is an account of a new virus found in the roots of normal-looking plants. The virus is thought to be a transitional stage between a pathogen and a non-pathogen. It is transmitted without the agency of insects, being water-borne. It is very resistant and can be kept for 4½ months in absolute alcohol without losing infectivity.

417* SMITH, K. M.

"Recent Work on the Plant Viruses."

Curr. Sci. 1936, **4**, 565-569.

This is a survey of the most important advances made in the study of plant viruses during recent years.

391* SMITH, K. M.

"Some Aspects of the Plant Virus Problem."

Sci. Progr. 1936, **30**, 413-421.

Repr. in *Rhod. Agric. J.* 1936, **32**, 134-142.

Some of the outstanding problems of plant virus study are discussed in this article which is the substance of an address given to Section K of the British Association at Norwich.

415* SMITH, K. M.

"The Virus Diseases of Glasshouse and Garden Plants."

Sci. Hort. 1936, 4, 126-140.

An account is given of the virus diseases affecting ornamental plants of glasshouse and garden. The increase in virus infection among this type of plant is pointed out and control measures are discussed.

389* SMITH, K. M. and DONCASTER, J. P.

"The Preparation of Gradocol Membranes and their Application in the Study of Plant Viruses."

Parasitology, 1935, 27, 523-542.

A detailed account is given of the technique of preparing Elford's collodion membranes for ultra-filtration and their use in the study of plant viruses is discussed. Full data are given of the preparation of twenty-two membranes and the percentage error involved in each case. The difficulties encountered in the preparation of the membranes are described.

440* SMITH, K. M. and DONCASTER, J. P.

"The Particle Size of Plant Viruses."

Rep. III Congr. Int. Path. Comp. Athens, 1936.

A short account is given of the work carried out on measuring the particle size of some representative plant viruses by means of ultra-filtration through collodion membranes.

385* WESTON, W. A. R. DILLON and BOOER, J. R.

"Seed Disinfection. I. An Outline of an Investigation on Disinfectant Dusts Containing Mercury."

J. Agric. Sci. 1935, 25, 628-649.

An outline is given of an investigation that has dealt with disinfectant dusts containing mercury, and it is shown that the majority of the inorganic mercury salts are of little value in this respect. Some organic mercury salts have been tested and the result of laboratory and field work suggests that there is a close relationship between composition and fungicidal power. In the series R-Hg-X, where R is a hydrocarbon and X an acidic radicle, the fungicidal power appears to decrease with the increase of the molecule of R. A study is made of the significance of X in the methyl series and the results as they apply to disease control are recorded on a series of graphs.

The specificity of some of the compounds is noted and a brief mention is made of the treatment of seeds other than cereals.

It is suggested that there is no evidence for stimulation in the sense of tonic effect but that instances of better germination, growth and crop yields are due not only to the control of seed-borne organisms but to the preservation of the food reserves in the seed from the attack of soil organisms or mould organisms adherent to the seed.

The phytocidal effects of the series R-Hg-X are described, their vesicant action, and relative toxicity as compared with mercuric chloride. Mention is made of the type of filler that was used.

400* WESTON, W. A. R. DILLON.

"The Sporulation of *Helminthosporium avenae* and *Alternaria solani* in Artificial Culture."

Trans. Brit. Mycol. Soc. 1936, 20, 112-115.

Helminthosporium avenae and *Alternaria solani* sporulate abundantly when exposed to a high light intensity.

Sporulation is induced by high intensity of visible white light.

Continued high light intensities increase the pigmentation.

It is suggested that there may be a need for an incubator under thermostatic and light control.

OTHER PAPERS.

SMITH, K. M.

"Plant Viruses and their Insect Vectors."

Rep. 4th Imp. Entom. Conf. 1935, pp. 68-70.

WESTON, W. A. R. DILLON.

"How Fungal Diseases Spread."

Annu. Rep. Hort. Supt. Norfolk. 1935, pp. 52-54.

WESTON, W. A. R. DILLON.

"Whiteheads or Take-All of Cereals."

Husbandry. 1935, 5, 120-121.

PLANT PHYSIOLOGY.

426* BARNELL, H. R.

"Seasonal Changes in the Carbohydrates of the Wheat Plant."

New Phytol. 1936, 35, 229-266.

The drifts of various carbohydrates in two varieties of wheat, Rivets and Wilhelmina, have been followed through two seasons in samples collected at sunrise. Well defined developmental drifts were shown by the sugars which were present during the greater part of each season in the following order of percentage amounts: sucrose, glucose, fructose. Starch was not demonstrably present at any time in the shoots and not in the ears until one to two weeks after ear-emergence. Hydrolysis with taka-diaxase provided a measure of easily hydrolysable polysaccharides and the drifts of the fermentable and non-fermentable fractions of the hydrolysis products were followed in shoots and ears. The drifts of the sugars, glycosides and polysaccharides in both shoots and ears are considered in relation to starch formation in the developing ear. Sucrose concentration in the wheat was shown to be sensitive to the temperature during the winter and spring, low temperatures causing high concentrations.

A comparison of the amounts of various carbohydrates in the two varieties of wheat showed practically no difference between them. In one season Wilhelmina showed a significantly higher sucrose content than Rivets up to the time of ear-emergence due to the greater sensitivity of the sucrose concentration in this variety to low temperatures. The drifts of the carbohydrates in the ears showed slightly different time relationships in the two varieties.

398* BELL, G. D. H.

"Experiments on Vernalization."

J. Agric. Sci. 1936, **26**, 155-171.

The effect of low temperature pre-treatment on the grain of some varieties of wheat, barley and oats varied with the variety and the time of sowing. Winter varieties showed greater acceleration in earing than spring varieties, and the response was more marked in later spring sowings than early ones.

Examination of the growing points in the early stages of development demonstrated more rapid growth and differentiation of the ear primordia in those varieties which showed earing acceleration.

The rate of tiller production, and the maximum number of tillers produced was also affected by the treatment, while in two of the three varieties in this trial the number of ears surviving at harvest was reduced by the treatment.

410* BELL, G. D. H.

"Vernalization: its Meaning and Practical Application."

Agric. Progr. 1936, **13**, 76-82.

A brief account of the technique and principles underlying vernalization, with the practical uses to which the process has been put in agriculture.

431* FYFE, J. L.

"The External Forces Acting on Chromosomes."

Nature. 1936, **138**, 366.

In *Silene Otites* Wibel the rod bivalents at metaphase I of meiosis occupy a position on the outside of the equatorial plate. Since the spindle attachments are wider apart in the rod bivalents than in the ring bivalents, this fact is in agreement with the hypothesis that metaphase represents an equilibrium of repulsions, as propounded by Darlington; the rod bivalents may be considered to be pushed to the edge by the repulsion from the poles.

In a note by Darlington the significance of the effect and its appearance in other organisms is discussed.

447* HUDSON, P. S.

"Vernalization in Agricultural Practice."

J. Minist. Agric. 1936, **43**, 536-43.

An outline is given of the phenomenon of vernalization and the technique of its application. The phenomena have been confirmed by a number of observers in different countries but it seems doubtful whether they will have any useful application to agricultural practice in this country. It is possible, however, that vegetable growers and seed merchants may derive considerable benefit from the application of vernalization to their plants.

OTHER PAPERS.

BUTTRESS, F. A.

"Seed Treatment. An Historical Retrospect."

Camb. Univ. Agric. Soc. Mag. 1936, **5**, (No. 1), 31-33.

SOILS AND MANURES.

396* CHILDS, E. C.

“Transport of Water Through Heavy Clay Soils. I.”

J. Agric. Sci. 1936, **26**, 114–127.

Following a basic assumption of water movement according to diffusion laws, the following results have been obtained :—

(a) The redistribution of water in the profile, with conditions of constant total moisture, i.e. no rainfall or irrigation, and no evaporation.

(b) The form of water profile at any time subsequent to the experimental determination of an initial profile, provided the surface is maintained in a saturated condition.

(c) The quantity of water which can penetrate the soil when the condition (b) is fulfilled, i.e. the maximum acceptable rainfall.

According to Flodkvist, excessive rainfall flows to the drains by passage along the surface of heavy soils, hence from (c) the conditions determining flushing of the drains can be determined.

397* NICHOLSON, H. H. and CHILDS, E. C.

“Transport of Water Through Heavy Clay Soils. II.”

J. Agric. Sci. 1936, **26**, 128–141.

Applying the theory of Part I, the coefficient of diffusion of the gault clay of the Cambridge University Farm (Youngman's Pasture) was found, and hence the maximum acceptable rainfall corresponding to certain known moisture profiles. The calculated rates of flow of the drain outfalls was found to be in fair agreement with the observed values.

394* CULPIN, C.

“Studies on the Relation Between Cultivation Implements, Soil Structure and the Crop. I. Some Preliminary Observations on the Measurement of Soil Structure with a Description of an Instrument for the Measurement of Soil Resistance.”

J. Agric. Sci. 1936, **26**, 22–35.

The paper stresses the need for physical measurements of soil structure to assist in studies of the relation between cultivation implements and plant growth.

The nature and measurement of soil compactness and “resistance” are briefly discussed. An instrument which gives an automatic record of the resistance to penetration of the soil by a steel probe is described.

A brief outline is given of studies on soil structure in relation to some cultivations. A relation between soil resistance and plant growth is demonstrated.

395* CULPIN, C.

“Studies on the Relation Between Cultivation Implements, Soil Structure and the Crop. II. The Effects of the Fowler ‘Gyrotiller’ on the Soil.”

J. Agric. Sci. 1936, **26**, 45–58.

A general account is given of four experiments in which the action on the soil of a large rotary cultivator, the Fowler “Gyrotiller,” was compared with that of the traditional cultivation implements. Differences in soil structure were demonstrated

and recorded by tests of compactness, resistance to penetration, degree of comminution and permeability.

It is shown that gyrotillage initially produced a loose and open soil to depths of 12 to 18 inches. On light land, weathering and the performance of seed-bed cultivations rapidly caused the disappearance of differences in the surface layers of gyrotilled and ploughed plots, but on heavy land, differences in the surface layers were demonstrable in one experiment for over a year. A greater looseness in the subsoil of gyrotilled plots persisted for upwards of a year on both light and heavy land.

408* GARNER, F. H. and SANDERS, H. G.

"Investigations in Crop Husbandry. III. The Effect of Time of Application of Sulphate of Ammonia to Wheat."

J. Agric. Sci. 1936, **26**, 316-327.

Over a period of six years seven field experiments were carried out to study the effect of time of application of sulphate of ammonia to autumn-sown wheat.

Three experiments were located on light gravelly soil which had been farmed highly for some years, and in those three cases sulphate of ammonia decreased yield, irrespective of time of application: the reduction in yield was of the order of 10 per cent. and is ascribed to more lodging and greater incidence of "foot-rot".

Three experiments were located on heavy clay soil in poor condition: in these sulphate of ammonia gave percentage increases of 18, 20 and 7.

Evidence is produced that early dressings of sulphate of ammonia do not affect germination or plant establishment, but that they tend to increase tiller formation by the end of February.

Early dressings tend to increase the number of ears at harvest, whilst late (May) dressings tend to increase ear size.

The optimum time of application will depend entirely on the weather of a particular season. When the winter is very wet autumn dressings are ineffective, whilst May dressings are very beneficial provided that the June rainfall suffices to wash them in; when the winter is dry early dressings are more effective than late.

It is recommended that half the dressing be applied at seeding time and that the other half be reserved for May application.

404* McMILLAN, J. A. and HANLEY, F.

"The Effect of Sowing Fertilizers in Contact with the Seed of Barley and of Sugar-Beet."

J. Minist. Agric. 1936, **42**, 1205-1211.

In field trials with early-sown barley, under moist soil conditions, drilling the fertilizer in close proximity to the seed gave definitely better yields than were obtained on the plots where the same quantities of fertilizer were broadcast on the seed bed. Other trials, however, demonstrated that under drier soil conditions the germination of the crop may be seriously impaired.

In trials with sugar-beet proximity of fertilizer to seed seemed to be fraught with considerable risk to germination, especially under dry soil conditions, though small quantities of sulphate of ammonia or superphosphate sown down a *separate* coulter appeared to assist the growth of the seedling.

OTHER PAPERS.

GARNER, F. H. and SANDERS, H. G.
"Top Dressing Wheat in May."
Fmr and Stk-Breed. 1936, 50, 327.

HANLEY, F.
"Soil Deficiency Troubles."
Husbandry. 1935, 5, 107-109.

STATISTICS.

429* WISHART, J.
"Tests of Significance in Analysis of Covariance."
Suppl. J. R. Stat. Soc. 1936, 3, 79-82.

It is sometimes necessary to compare group means after adjustment for regression by means of a covariance analysis. The standard error of a difference between two such corrected means has been given, but only for the case of a single independent variate. In this paper the formula is worked out for the general case of any number of independent variates, and an example of its use in an agricultural experiment is given.

430* WISHART, J. and HIRSCHFELD, H. O.
"A Theorem Concerning the Distribution of Joins Between Line Segments."
J. Lond. Math. Soc. 1936, 11, 227-35.

The problem is here considered of a line which is divided into a number (n) of segments which may be of two kinds, e.g. black or white. The probabilities that a segment is of one kind or another are given, and are supposed constant over all segments. By means of the moment generating function method the distribution law of the probabilities for any number (v) of black-white joins among the n segments is determined, and its limiting form for large n is shown to be the Gaussian error law, with a mean and standard deviation which are worked out, together with certain higher order semi-invariants of the exact discontinuous distribution. For equal probability of black or white the distribution is the symmetrical binomial.

WISHART, J. and SANDERS, H. G.
"Principles and Practice of Field Experimentation." Pp. v + 100.
Empire Cotton Growing Corporation, 1935. Price 3s.

This is a manual for experimentalists in which the modern technique of plot arrangement and analysis of results by statistical methods are described and illustrated. The first part "Principles," deals with the statistical methods used, the objects of an experiment, and various methods based on the analysis of variance technique, such as randomized blocks, the Latin Square, and simple cases of multiple factor experiments. There is a full account of the analysis of covariance method of dealing with data in two variables. In the second part, "Practical Considerations", general procedure, broad questions of policy, the questions an experiment is expected to answer, and the care to be taken in selecting sites, are first discussed. The agricultural significance of experimental results, and the limitations of the single trial are

commented on. Observation plots are recommended, and questions of size, shape and arrangement of plots generally are taken up. The observations to be taken on plots, including the important question of sampling, are discussed, and the latter illustrated. Tables are provided of probabilities associated with the normal curve, the "Student" *t*-distribution and Fisher's *z*-criterion.

OTHER PAPERS.

- 420* WISHART, J.
"Statistics in Chinese Agricultural Research."
J. Amer. Stat. Ass. 1936, **31**, 127-128.

MISCELLANEOUS.

- 432* DEIGHTON, T.
"A Precision Thermometer for the Temperature Regulation of a Room."
J. Sci. Instrum. 1936, **13**, 298-300.

A thermostat capable of regulating the temperature of a small room with a variation of only $\pm 0.01^{\circ}\text{C}$. has been constructed. The principles involved are (a) great turbulence of the room air and (b) the provision of two connected expansion chambers, one controlled by the room temperature and the other, a subsidiary one, controlled by the heating apparatus itself, serving to take up the lag at once, whenever the relay is operated. The apparatus is simple, cheap and efficient and has been in use for eighteen months.

- ENGLEDOW, F. L.
"Report on the Commission of Enquiry on the Scientific Department, Indian Tea Association, 1935-36."

A review of the research situation in connection with tea growing in Northern India and of the possibilities of co-operative research among the chief tea growing countries.

PUBLICATIONS.

Animal Nutrition Research Institute.

East Anglian Pig Recording Scheme. Reports, 1-3, 1929-30.

(These Reports have been discontinued).

To be obtained from The Secretary, School of Agriculture, Cambridge, ENGLAND. Price 1s. each.

Cambridge University Agriculture Society Magazine (Issued Annually
3 numbers comprising a volume).

Vol. 1. (1924-26). Vol. 1. No. 1. 1924 *Out of Print*.

Vol. 2. (1927-29).

Vol. 3. (1930-1932).

Vol. 4. (1933-1935).

Vol. 5. (1936).

To be obtained from The Editor, School of Agriculture, Cambridge, ENGLAND.
Price, per number, 1925-1932, 1s. Post Free ; 1933-35, 2s 6d. net or 2s. 9d. Post Free.

Farm Economics Branch.

Farmers' Bulletin No. 1. " Interpretation of Farm Accounts." (*3rd Edition*.)
Price 6d. Post Free.

Farmers' Bulletin No. 2. " Financial Results of Farming in the Eastern Counties
of England. Preliminary Statement for 1932." Price 6d. Post Free.

Farmers' Bulletin No. 3. *Same as No. 2, only for 1933.*

Farmers' Bulletin No. 4. " Farm Profits and Some Profitable Farms." Price 6d.
Post Free.

Farmers' Bulletin No. 5. " Management in Milk Production." Price 6d. Post
Free.

Report No. 1. " An Economic and Financial Analysis of Fourteen East Anglian
Farms in 1923-24." (*2nd Edition*.) Price 1s. net. Postage 1d.

Report No. 2. " An Economic and Financial Analysis of Six Eastern Counties
Farms in 1924-25." (*2nd Edition*.) Price 1s. net. Postage 1d.

Report No. 3. " An Economic and Financial Analysis of Fifteen East Anglian
Farms in 1924-25." (*2nd Edition*.) Price 1s. net. Postage 1d.

Report No. 4. " An Economic and Financial Analysis of Seven Eastern Counties
Farms in 1925-26." (*Out of Print*.)

Report No. 5. " A Successful Norfolk Poultry Farm, 1922-26." (*3rd Edition*.)
Price 1s. net. Postage 1d.

Report No. 6. " An Economic and Financial Analysis of Thirteen East Anglian
Farms in 1925-26." Price 1s. net. Postage 1d.

Report No. 7. " The Economy of a Norfolk Fruit Farm, 1923-26." Price 2s. net.
Postage 2d.

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